STAYING THE COURSE: FACTORS THAT AFFECT POSTDOCTORAL TRAINEE PERSISTENCE IN ACADEMIA

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by

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ABSTRACT

Nearly 70% of US-trained doctorates in the biomedical sciences enter postdoctoral training, yet only 21% of biomedical postdoctoral scholars (postdocs) are estimated to achieve tenured or tenure-track faculty positions. Thus, there is a need to better understand the career intention patterns of postdocs and the factors that influence disparate career goals, especially for women and underrepresented minorities (URM). Based on psychosocial theories for career development and motivation, this study examines the career goals of over 1300 biomedical postdoctoral researchers and the factors that influence commitment to or divergence from conventional academic research careers. We report decreases in the number of postdoctoral researchers' intending to pursue careers in academia only in the first two years of training. Those postdocs who are pursuing careers outside of academia have fewer publications, lower first-author publication rates, lower research self-efficacy, and different career expectations and values than those opting for research careers in academia. We found that 34% of even the most productive postdocs opt out of academia, citing expectations about job prospects and financial security.

We also found that female and URM postdocs reported lower publication rates. Interestingly, female postdocs on average had lower self-efficacy than males, while URM postdocs were found to have higher self-efficacy than non-URM postdocs. Many of the postdocs who felt most comfortable choosing academic careers cited adequate support with family and childcare, financial stability, and geographical flexibility. We propose a model whereby motivations for academic careers are strengthened or weakened through self-efficacy, outcome expectations, and values during the postdoctoral training period, resulting in career goal persistence or the

changing of a career intention. The results from this study help to advance our understanding of why postdocs are motivated to persist toward a career goal against considerable odds.

BIOGRAPHICAL SKETCH

Dr. Marcus Lambert serves as the Assistant Dean for Diversity and Student Life in the Weill Cornell Graduate School of Medical Sciences and Assistant Professor of Education Research in the Department of Medicine. He also co-directs the Office of Student Diversity at Weill Cornell Medicine, focusing on research and data collection efforts for the office. Dr. Lambert is a well-respected voice in graduate biomedical diversity and brings a strong passion for the training and development of groups underrepresented in science. He has been invited as a guest lecturer at institutions such as the Fred Hutchinson Cancer Research Center, Georgetown University, and The Jackson Laboratories. He currently directs a summer research program for undergraduate students and serves on committees and boards of multiple diversity organizations.

Dr. Lambert received his bachelor's degree from Howard University and his doctorate in biomedical science at New York University School of Medicine. He studied education policy and mentoring programs at the New York Academy of Sciences and has now received additional training in Clinical Epidemiology and Health Services Research. Trained both as a basic biomedical scientist and in social science methodology, his research efforts focus on interventions in areas of diversity and career development. Dr. Lambert resides in Brooklyn, NY with his wife and six children.

Dedicated to my wife, Zahara, who has been my greatest supporter.

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CHAPTER 1

INTRODUCTION & METHODS

Introduction

Recent reports signify a declining interest in academic careers among a growing pool of biomedical and biological PhD students, particularly as they progress in their graduate training [2-5]. Additionally, more women and underrepresented minority (URM) trainees have been shown to opt for careers outside of academia before and during their postdoctoral training, contributing to the dearth of faculty diversity in academia [4, 6]. Overall, PhDs are entering postdoctoral training with interests in a broad array of career paths including academia, industry/for-profit, and non-research positions, suggesting for some that the postdoc has become a default or "holding pattern" for further career planning [7]. With 70% of biomedical PhDs initiating postdoctoral training after they graduate, pursuit of postdoctoral training is often independent of a clear career goal [8]. To further support this notion, many researchers have found that many postdocs are offered structured career development support too late in their training [2, 9, 10]. Is this sufficient to explain why biomedical researchers move away from the academic PI track while conducting their postdoctoral training? Reports examining determinants of doctoral student career choice may provide clues.

Gibbs, Griffin and colleagues have noted that high interest in academia at the beginning of the PhD, high research self-efficacy, and higher first-author publication rates were positively associated with interest in faculty careers at research universities [4]. Clair *et al.* examined the strategies and resources that trainees use to prepare for a

broad job market, finding evidence that trainees are driven by their self-efficacy in the career search process, and not by general interests in careers [11]. Roach and colleagues also note that declining interest in academic careers was not driven by expectations of academic job availability or the availability of research funding, but instead due in part to the misalignment between students' changing preferences for specific job attributes and the nature of the academic research career itself. For example, students who lose interest in academia later in their PhD training where found to have stronger interests in job attributes such as commercialization rather than basic research [5]. However, it is not clear whether these attributes cause a shift in career interests or if they are simply associated with new interests in careers such as industry or startups because postdocs believe these attributes to be necessary for success in these careers. While these reports address some predictors for doctoral trainees' career preferences, the factors that influence the specific population of *postdoctoral trainees* are not yet well-characterized. Those who have started to explore this training stage acknowledge the differences between populations [9, 11].

By sampling over 1300 biomedical postdocs from across the United States, we examine the motivation for persisting along an academic career trajectory. We hypothesize that a significant number of postdocs enter their postdoctoral training with aspirations of becoming faculty members in academia, but may seek alternative careers due to uncharacterized influences. Thus, the aims of this study are: (1) to characterize the self-efficacy, outcome expectations, personal values, and other predictors of career choice and persistence (motivation) among postdoctoral researchers, and (2) to identify specific factors which might be targeted to support the career decision process of postdocs.

U-MARC Survey

Postdoctoral scholars (postdocs) in the biological and biomedical sciences were asked to complete an original survey instrument entitled U-MARC (Understanding Motivations for Academic Research Careers). The 70-item survey (1) assess participants views on factors associated with careers in science and (2) measures outcome expectations and self-efficacy around research careers using two original scales. Durable career interests are thought to be maintained by positive self-efficacy and outcome expectations. *Self-efficacy* refers to the belief in one's own ability to succeed at a particular behavior, and *outcome expectations* refer to the belief that a behavior will lead to a specific outcome. However, current literature suggests that while self-efficacy and outcome expectations are important, other contextual factors (that may be specific to the biomedical training experience) may help to determine to scientific career choice-related behavior [8, 12]. Our study's theoretical framework is based in (i) *Social Cognitive Career Theory* which states that self-efficacy, outcome expectations, and personal goals influence career decision and (ii) *Vroom's Expectancy Theory* which assumes that motivation is an outcome of how much an individual wants a reward (valence), the likelihood that a particular effort will lead to the expected performance (expectancy) and the belief that the performance will lead to the reward (instrumentality) [13, 14]. If the outcomes available from high effort and high performance are not attractive to the individual, motivation will be low. We used expectancy theory to develop the outcome expectations questions in the U-MARC survey (**Figure 1**).

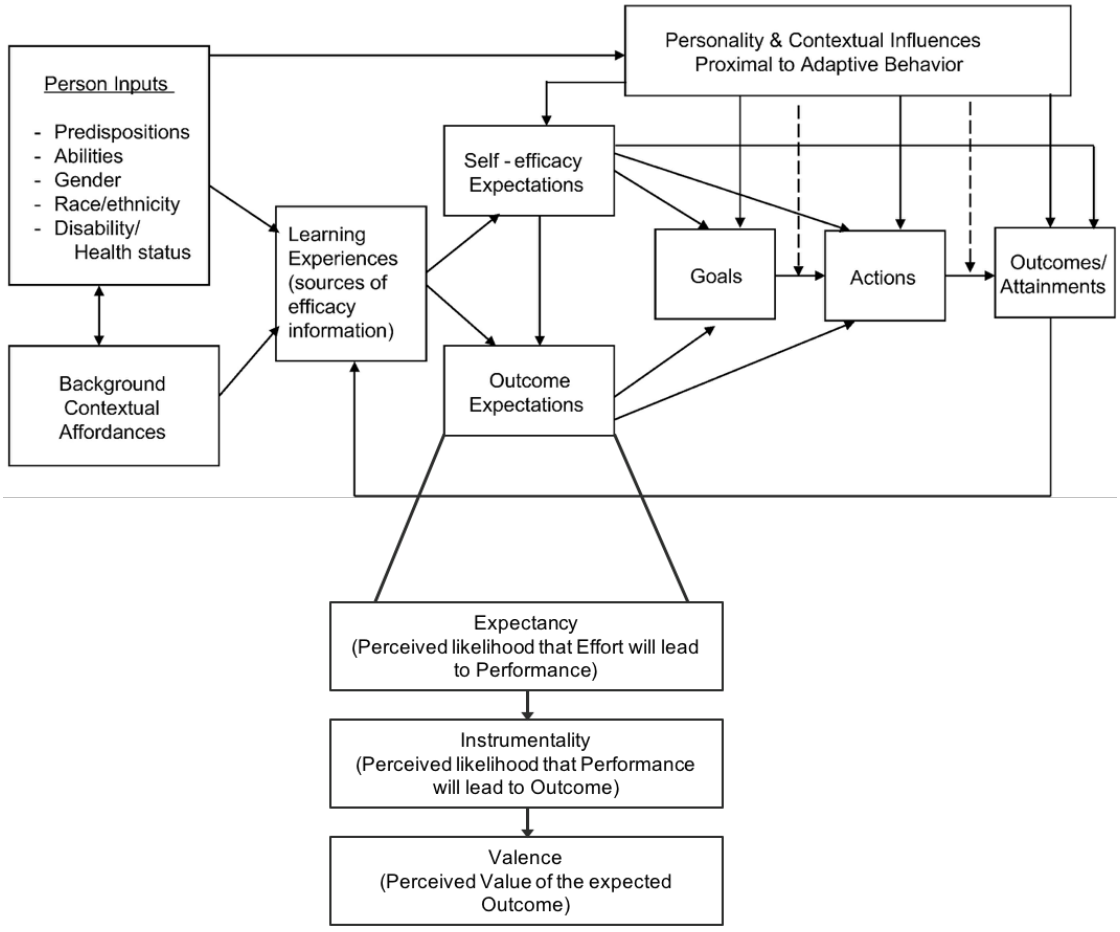


Figure 1 - (Modified) Social Cognitive Career Theory Model. The Social Cognitive Career Theory was modified from Lent *et. al*. [1], to include Vroom's model of expectancy theory for motivation.

Data Collection and Procedures

All work was done under the approval of the Weill Cornell Medical College Institutional Review Board (IRB# 1612017849), and all respondents provided consent for participation in the study. A purposeful sampling strategy instead of snowball sampling was used where participants were recruited through postdoctoral listservs from top-ranked research universities and institutions. A list of participating institutions can be found in **Appendix B.** Only respondents who identified as a

postdoctoral scholar or research associate were included in the analysis (n=1348). MD's and MD-PhD recipients were excluded from the analysis. Of these, respondents who reported that they were not a postdoc (n=36) were not included in the analysis. Representation was sought from a variety of biomedical fields across the United States, with an oversampling of postdocs who were U.S. citizens or permanent residents, women and underrepresented minority (URM) participants (**Figure 2**). Sampled postdoc participants represent 8% of the total pool and nearly 20% of eligible postdocs from URM backgrounds. The 70-item anonymous U-MARC survey instrument was collected via REDCap.

On the survey, respondents were asked to rate their interest in pursuing each of the following career pathways: (i) Academic (Faculty), Research Intensive, (ii) Academic (Faculty), Teaching Intensive, (iii) Other Research Intensive, (iv) Non-Research, Science-Related, or (v) Non-Science Related as well as complete self-efficacy and outcome expectations instruments using a 5-point Likert scale. They were then asked to agree or disagree with statements about influential factors using the 5-point Likert scale (**Table 1**). Next, were statements regarding outcome expectations and finally self-efficacy (**Tables 2 and 3**).

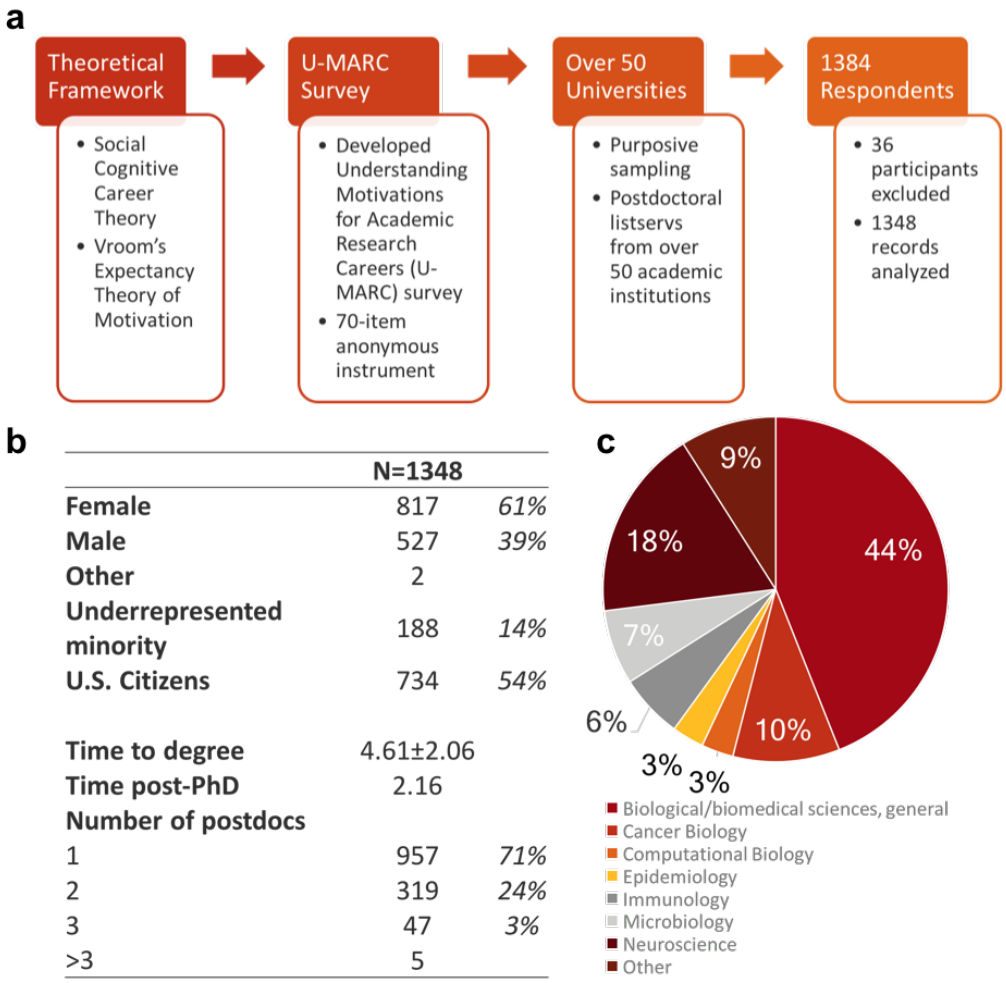


Figure 2 - Study design summary and characteristics of U-MARC survey participants. (a) Using a theoretical framework based on two theories, U-MARC was developed and distributed to over 50 universities and research institutions. (b) Over 1300 postdocs participated in the study. Time to degree and time post-PhD represented median values.

Table 1 - Questions regarding factors that influence career intention.

My career choice is highly influenced by the current **grant funding** climate.
Guidance from my lab PI has highly influenced which career path I will pursue.
Guidance from **mentors other than my PI** has highly influenced which career path I will pursue.
My career choice is highly influenced by **my passion for science** and discovery.
My career choice is highly influenced by **my success thus far in research** (grants, publications, awards).
My career choice is highly influenced by **my personal life circumstances**.
My career choice is highly influenced by the **job prospects** my field.
My career choice is highly influenced by **my immigration status** or citizenship.
Financial security is one of the top reasons for my career choice.
My career choice is highly influenced by the career choices of my friends.
My career choice is highly influenced by my **responsibility to my family** (significant other/spouse, children, and/or other dependents).
My career choice is highly influenced by the **lifestyle** of those in the positions that I want.
My career choice is highly influenced by the **impact that I can make on society** or to a community.
My career choice is highly influenced by the **prestige** that comes with the field.
My career choice is highly influenced by my racial/ethnic representation in science.

Table 2 - Questions regarding expectations about careers.

If I work hard in the lab I can expect a **publication in a top journal**.
There is a good correlation between my **work effort and performance in the lab**.
I will be **successful in receiving grants** and funding as long as I put in the right amount of effort.
Publications in top journals will lead to a faculty position.
Independent grant funding will lead to a faculty position.
A research-intensive faculty position would require **more than one postdoc position**.
A research-intensive faculty career would be **very satisfying** for me.
A research-intensive faculty career would increase **my sense of self-worth**.
My peers would **think highly of me** if I obtain a research-intensive faculty position.
Pursuing a research-intensive faculty position would enable me to associate with the kind of **people that I value most**.

Table 3 - Questions regarding research self-efficacy.

I have the ability to **achieve a successful career as a researcher**.
I can publish in **top scientific journals** like Science, Nature, and Cell.
I am confident that I can **secure grants in my field**.
I can develop **novel and successful research ideas**.
I can **mentor and supervise others** in their training.

CHAPTER 2

FACTORS THAT AFFECT POSTDOCTORAL TRAINEE PERSISTENCE IN OR DIVERGENCE FROM ACADEMIA

Academia remains a top choice for biomedical postdocs

To better understand the career paths that postdoctoral fellows intend to pursue, survey participants were asked to rank the following career paths on a 5-point Likert-type scale from *Most likely to pursue* to *Least likely to pursue*: (1) Academic (Faculty), Research-Intensive, (2) Academic (Faculty), Teaching-Intensive, (3) Other Research-Intensive (e.g. Industry), (4) Non-Research, Science-Related, and (5) Non-Science Related. [Similar career outcomes taxonomy has also been used by others.] 48% or respondents intend to pursue academic, research-intensive positions, 11% academic, teaching-intensive positions, 27% research positions outside of academia, 13% non-research, but science-related positions, and 2% non-science related positions (**Figure 3a**). Three quarters of postdocs intend to pursue research careers, either in academia or other sectors such as industry. Despite the well-documented odds of obtaining an academic faculty position, 59% of biomedical and biological postdocs who were sampled intend to pursue faculty positions in academia, whether in teaching or research. For simplification, reference to *academic careers* will focus on research faculty positions and exclude teaching-intensive positions, since they comprised only 11% of this pool.

We then asked respondents to indicate how their commitment to their career goals have changed since starting their postdoctoral position. Of the 48% of postdocs

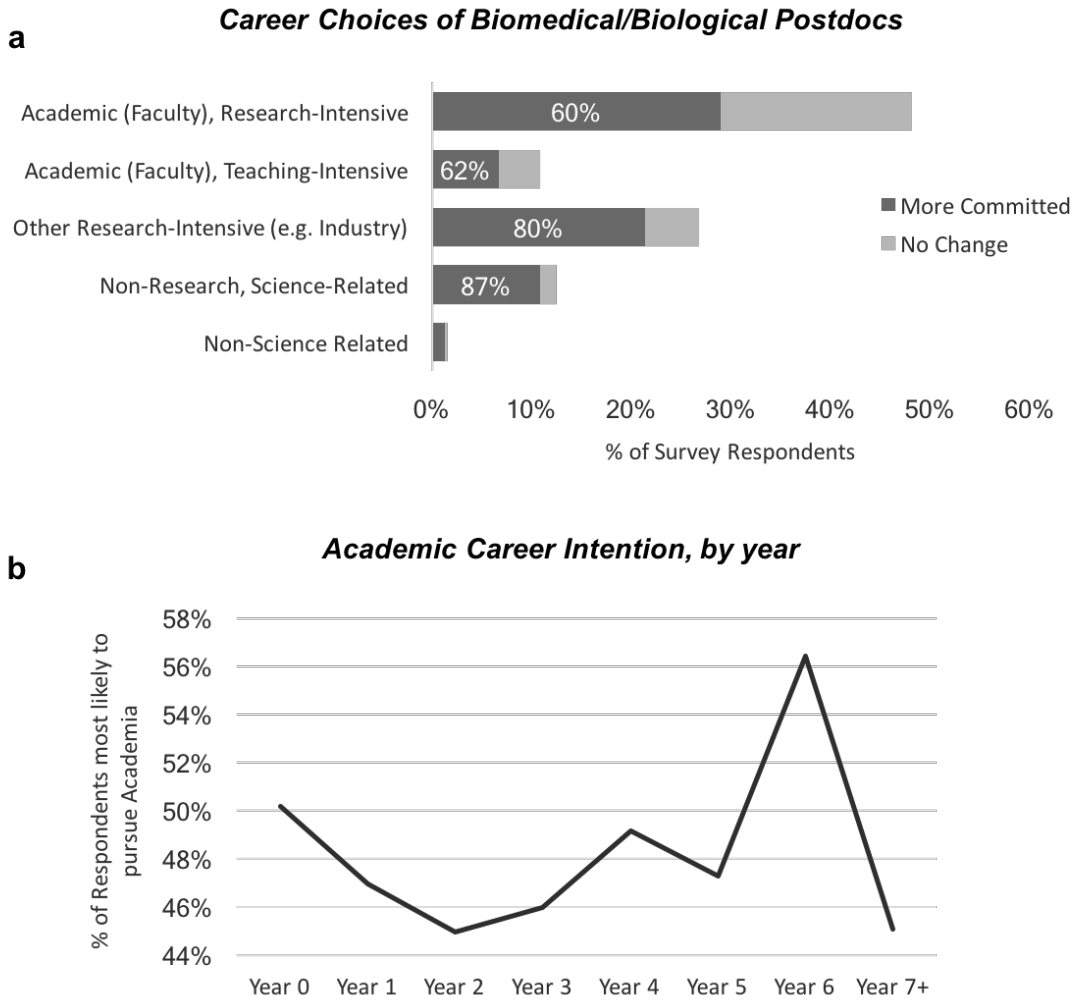


Figure 3 - Career intention patterns of biomedical postdocs. (a) The percent of respondents who will most likely pursue each career path. Within each career path, respondents were asked to indicate their change in commitment to this path since starting their postdoctoral position. (b) The percentage of postdocs most likely to pursue academia, across their year in training.

who intend to pursue an academic faculty position, 40% had not changed their commitment since starting their postdoc, suggesting that these postdocs are persisting towards an academic career (**Figure 3a**). The remaining 60% had become more devoted to an academic career since starting their postdoc. Whereas 80% of postdocs intending to pursue nonacademic research positions (i.e. industry) had become more committed to this path since starting their postdoc. 87% and 84% of non-research and

non-science positions respectively demonstrated the largest percentage of postdocs within a career path who have changed their career commitment since starting their postdoc. It's important to note that postdocs were permitted to indicate commitment to multiple career paths. For example, 60% of postdocs who were more committed to nonacademic research careers, were also more committed to at least one other career path.

To determine if academic career interests decline over the course of the postdoctoral training period, we explored the career intentions of postdocs by year, cross-sectionally. 50% of respondents intended to pursue academic positions in the first year of their postdoc, yet by their 2nd year this number had dropped by 5%, suggesting a shift in the number of postdocs committed to this path before year 2 (**Figure 3b**). Interestingly, the percentage of postdocs intending to pursue academic careers rise to 56% between years 2 and 6. By the end of year 5, 56% of biomedical postdocs intend to pursue academic positions. Beyond year 7, intention to pursue academia drops back to 45%.

In a separate analysis, we explored those respondents who were less committed to academia, and nearly 70% will likely pursue other research-intensive positions outside of academia. That is, 70% of those postdocs who have become less interested in academic research positions will likely pursue research in industry or pharma. Overall, these data suggest (1) career intentions do not remain static from the point of development and (2) the percentage of postdocs pursuing research careers in academia declines until year 2 but rises to well above 50% after 5th year. Thus, academic career intentions are either reinforced or redirected as postdocs progress in their training, most likely leading to industry-related interests if commitment to academia wanes.

Multiple factors drive postdocs away from academia

To understand the factors that contribute to persistence towards or divergence from an academic research careers, we posed a series of questions to participants (**Table 1**) and identified the most influential factors for those who intend to pursue academic research positions vs. those who are most likely choosing other career paths, including teaching-intensive faculty positions, nonacademic research positions (e.g. Industry), non-research but science-related positions, and non-science related positions. As expected, the current grant funding climate and job prospects in their field were the top factors influencing the career intentions of those who are opting for careers in sectors other than academia (**Figure 4a**). Although, the data doesn't specify whether these factors have a positive or negative influence on career intention, the

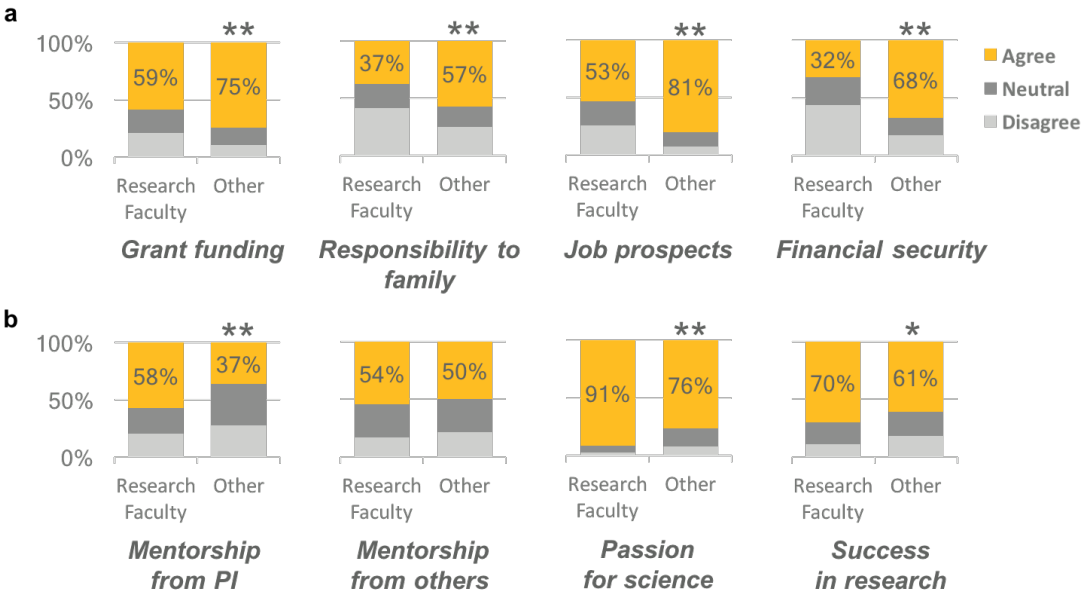


Figure 4 - Top factors associated with those who intend to pursue careers outside of research faculty, by percent respondents. (a) Top factors associated with those who intend to pursue career paths other than research faculty (academia). (b) Top factors associated with those who are pursuing research faculty (academic) positions. **p<0.001, *p=0.001

decline in grant funding and available faculty positions in the biomedical sciences are well-documented.

Participants also identified financial security and responsibility to family (significant other/spouse, children, and/or other dependents) as top factors. Despite a higher percentage of married or domestic partnerships among those pursuing research positions in academia (68% vs. 62% for other postdocs), a significantly larger percentage of those pursuing nonacademic careers cited *responsibility to family* as an influential factor in their career choice (**Figure 4a**). Similarly, 28% and 25% of academic and nonacademic-bound respondents, respectively, indicated having children or other dependents. Therefore, marriage/domestic partnership or having children does not explain the differences in career intention.

Career guidance from mentors

In order to better understand the role of mentorship in career intentions, we asked participants to rate how influential their PI is in their career choice. Only 58% of those intending to pursue an academic career agreed that they received career guidance from their PI (**Figure 4b**). The percentage was significantly lower at 37% for those pursuing nonacademic positions. We also asked about mentorship from those other than their PI. There was no significant difference between academic and nonacademic-bound respondents, with about half of postdocs indicating a lack of career guidance from mentors other than their PI.

Performance outcomes are often cited as a determining factor in the ability of an individual to perform a task. If an individual has performed a task well previously, he or she is more likely to feel competent and perform well at a similarly associated task [15]. So, we asked participants whether their success in research thus far (grants,

publications, awards) played any role in their career intentions. A significantly higher number of postdocs pursuing research faculty positions acknowledged that this has in fact influenced their career intention (**Figure 4b**). It is also worth noting that postdoc's passion for science and discovery was significantly higher for those pursuing academia, but also high for those pursuing other paths.

Expectations about research career outcomes explains lack of intention

As implied by the social cognitive career theory, self-efficacy beliefs and outcome expectations are central to the development of career interests. Thus, we designed a scale focusing on outcome expectation items as well as a research career self-efficacy scales. The outcome expectations scale was based on Vroom's expectancy theory for motivation, which posits that (1) *Expectancy* (will my effort lead to high performance?), (2) *Instrumentality* (will performance lead to desirable outcomes?), and (3) *Valence* (do I find the outcomes desirable?) lead to a motivational force (cite). If any one of these parts are low, then it decreases motivation. We formulated questions around expectancy (**Figure 5a**), instrumentality (**Figure 5b**), and valence (**Figure 5c**), and found that postdocs who are pursuing research faculty careers score significantly higher on our outcome expectations scale than those pursuing other careers (3.49 vs. 2.99, $p<0.001$). This suggests that postdocs pursuing research faculty paths expect to publish and obtain the grants necessary to achieve faculty, are confident that those publications and grants are instrumental to their goals, and highly value their goal of becoming faculty. Thus, these postdocs have a higher motivation to achieve them.

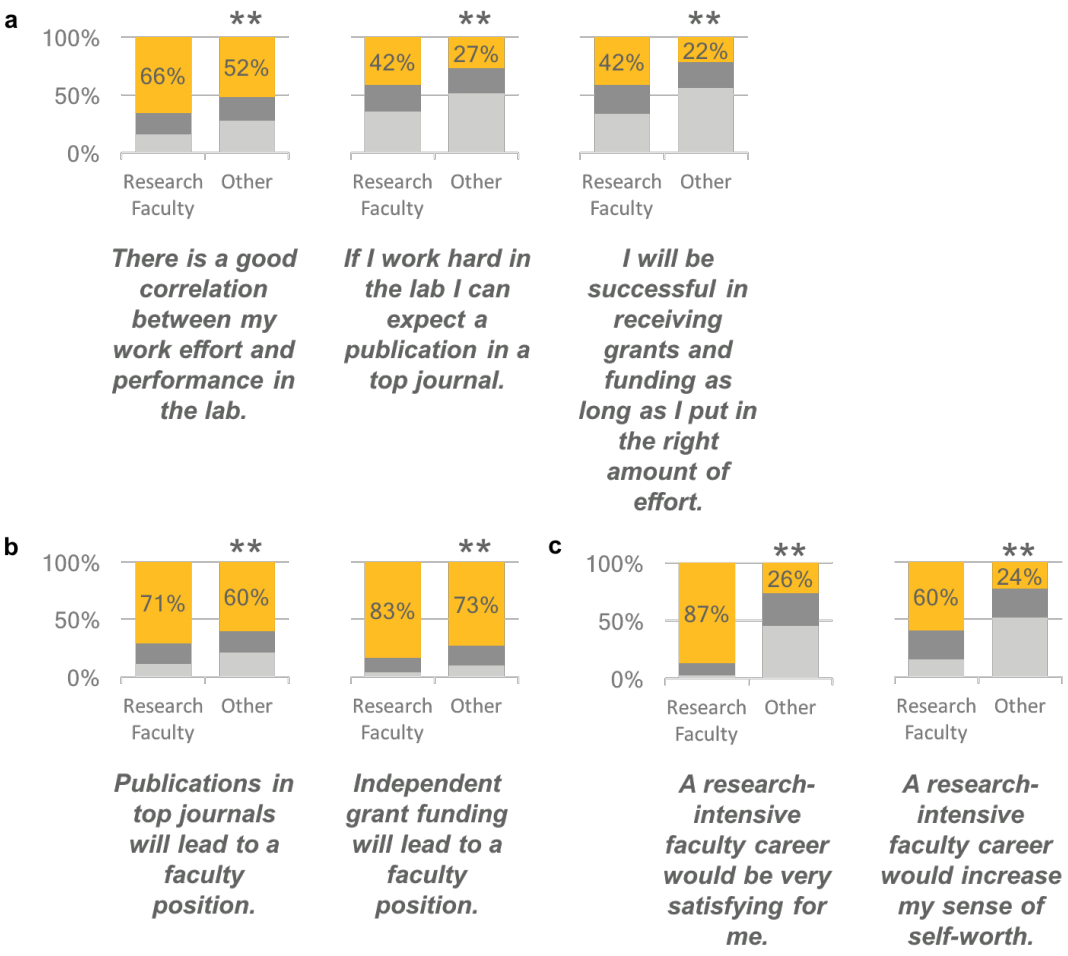


Figure 5 - Research Career Expectations. (a) Percent respondents for expectancy (will my effort lead to high performance?), (b) instrumentality (will performance lead to desirable outcomes?), and (3) valence (do I find the outcomes desirable?). ** $p<0.001$

Nonacademic-bound postdocs have lower research self-efficacy

Since SCCT also outlines the importance of self-efficacy to career goals, we designed a self-efficacy scale specifically for research careers. Research career self-efficacy refers to an individual's personal beliefs about his or her ability to perform particular behaviors or courses of action that will achieve a research career. Only 63% of postdocs choosing careers outside of research academia felt as if they had the

ability to achieve a successful career as a researcher compared to 84% of postdocs seeking research academia (**Figure 6**). Of the 63%, only half (53%) are seeking research careers in sectors such as industry, suggesting that the lower self-efficacy is not unique to one career path.

Self-efficacy for publications and grants were equally poor with only 30% of respondents who are pursuing nonacademic careers confident in their ability to publish in top journals or secure grants in their field. Overall, postdocs who sought academic careers had higher research career self-efficacy than postdocs pursuing other paths (3.84 vs. 3.47, $p<0.001$).

Figure 6 - Research Self-efficacy. Percent respondents were compared across intention to pursue research faculty positions (academia) or "Other" (research positions outside of academia). ** $p<0.001$

Publication patterns for postdocs

As a metric of scientific productivity, we asked participants to report their total number of publications, their number first-author publications, and the impact factor of their best publication. Postdocs who intend to pursue academic research careers produced significantly more publications (9 vs. 7, p<0.001) (**Figure 7a**), more first-author publications (4 vs. 3, p<0.001) (**Figure 7b**) and had a higher first-author publication rate (0.56 vs. 0.42, p<0.001) (**Figure 7c**), calculated by dividing the number of first author publications produced by the number of years since they started

Figure 7 - Assessing productivity of those who intend to pursue research faculty (academia). (a) The mean number of publications, (b) first-author publications, (c) first-author publication rate, and (d) the highest impact factor of the journals in which participants had published. (e) Percent respondents whose total publications and highest journal impact factor was in the 75th percentile or above. (f) Top factors associated with postdoc in the 75th percentile. ** p<0.001

their PhD. This rather crude measure of productivity was easy to self-report and has been shown to be predictive of becoming a PI in academia [16]. The highest impact factor of the journals in which participants had published was not significantly different between those choosing academic vs. nonacademic careers (**Figure 7d**).

Many of the most productive postdocs opt out of academia

To better understand the career intentions and factors that influence even the most productive postdocs, we further assessed the respondents whose total publications and highest journal impact factor was in the 75th percentile or above. 64% of respondents intend to pursue academic research faculty positions, while 36% are choosing other careers, including other research-intensive positions outside of academia (**Figure 7e**). Only a very small percentage are intending to leave science or pursue a teaching-intensive faculty position.

We then further assessed the factors that influenced intention to pursue academic research careers. 89% of postdocs who are choosing other careers noted that current job prospects were an influential factor compared to 48% of academic-bound postdocs (**Figure 7f**). 70% also cited financial security as an influential factor for their career choice outside of academia. Finally, we observed that more than 90% of academic-bound postdocs were confident in their ability to achieve a research faculty position (**Figure 7f**).

DISCUSSION

The purpose of this study was to examine the factors influencing the career choice of postdoctoral researchers (postdocs) in order to better understand the motivation to persist in academic, research-intensive positions. Currently, the number

of biomedical postdoctoral researchers (postdocs) trained in the United States far exceeds the available faculty positions within academia. In the early 1970s, the number of NIH principal investigators (PIs) was equivalent to the number of biomedical postdocs and exceeded the number of biomedical graduate student researchers by more than 50% [17]. The number of biological and medical science postdocs began to rise in the 1980s and doubled from 1990 to 2010. Recent years (2011-2016) have marked a decline in the postdoc population [18], but the academic job market remains increasingly competitive for biomedical PhD graduates. Only 21% of biomedical postdocs are estimated to achieve tenured or tenure-track faculty positions, however some institutions report higher success rates especially when "tenure-track" definitions are broadened to academic faculty positions, including those holding titles of assistant, associate, or full professor at a university, or an equivalent title at a research or government institution. However, it is still unclear how these statistics and the competitiveness for academic positions affect the career intentions of current biomedical postdoctoral researchers.

In this study, we show that a large number (59%) of biomedical and biological postdocs intend to pursue faculty positions in academia, whether in teaching or research. These postdocs, on average, have more positive outcome expectations, higher self-efficacy and are more productive (in terms of publications). Many recognize grant funding and job prospects as challenges, but most don't find them influential enough to alter their intentions to persist. While not a realistic reality for many postdocs, most who pursue academia don't find family responsibilities or financial insecurity as influential factors to their career goals. Like most postdocs, they are very much driven by their passion for science and their success thus far in research. While, only half may be getting the proper mentorship that they need, this has not been a critical factor for persistence.

What does seem to be key for divergence from academia, even for the most productive postdocs, are the expectations around available jobs and financial security. Gibbs and colleagues have noted examples of these expectations before: “I had a postdoc in my lab who had three *Nature* publications. Three! It took him two-and-a-half years to find a job. He is a very smart person, very good with mentoring … But I am like, if that type of person, [who] did this well cannot find a position … He ended up going to [an institution] and it is obvious that he didn't want to live there, but he had been a post doc for six years. He just had to move on. He had no control whatsoever in that.”

We report that not only do these outcome expectations follow PhD’s into their postdocs, it remains an influential factor in their career choice. Future studies, should explore the outcome expectations and self-efficacy of postdocs across demographics such as gender, race and ethnicity and citizenship. Future studies should also explore opportunities and targets for interventions. A better understanding of the factors that support persistence and divergence from research careers will help postdocs make better career-related decisions earlier in their training path.

CHAPTER 3

BARRIERS TO ACADEMIC CAREERS FOR DIVERSE POSTDOCTORAL TRAINEES

INTRODUCTION

To meet our nation's increasingly diverse health needs, higher education institutions must focus on educating and training a diverse and inclusive generation of researchers. Yet despite efforts to diversify the biomedical workforce, the professoriate remains largely homogeneous. Efforts to increase women and historically underrepresented minority (URM) faculty, for example, in the biomedical sciences have resulted in minimal change in the past 50 years [19, 20]. Scientists from URM backgrounds earn 10% of life science PhD's but comprise only 2% of medical school basic science faculty [21]. Ensuring the best researchers from all backgrounds are represented in academia will strengthen the translational research enterprise, but requires a better understanding of the factors that influence career choice and how they might differ for scientists from underrepresented groups.

The conventional research pipeline model tracks students as they transition from college through training stages and into tenure-track faculty positions. However, a number of leaks in this pipeline cause trainees to drop out at every transition stage, the most startling occurring from postdoc to faculty. The percentage of doctoral graduates in the biological sciences who have secured a tenure-track position within six years of completing their PhD has shifted from 55% in 1973 to just 15% in 2006 [22]. Recent reports have shown that biomedical science graduate students become

less interested in faculty careers as training progresses [4, 6, 9]. Women and URM graduate students are even more likely than their well-represented counterparts to report a significantly less interest in research-intensive faculty careers. Even when publication-rate and other hallmarks of research success are normalized, differences in career interest persist [9].

Much like a patient, a student's motivation towards a goal-oriented behavior can be predicted by behavioral science theories. By examining the factors influencing the career choice of recent biomedical PhD graduates, we can better understand the motivation to persist in academic, research-intensive positions, particularly among URM and women. We hypothesize that a significant number of postdocs enter their postdoctoral training with aspirations of becoming faculty members in academia, but may seek alternative careers due to unknown and uncharacterized influences. Moreover, we hypothesize that differences in the interests and experiences of URM and female postdocs may account for lower numbers of URM and female faculty members. Thus, chapter 3 aims:

(1) To characterize the self-efficacy, outcome expectations, scientific values, and other determinants of career choice and persistence (motivation) among postdoctoral researchers from diverse backgrounds.

(2) To identify specific factors which affect the career decision process of URM and women postdocs.

RESULTS

Career intention patterns of biomedical postdocs across gender, race, and citizenship

To better characterize and understand the career choices of postdoctoral researchers from diverse backgrounds, we assessed the previously reported U-MARC data by gender, race and ethnicity and citizenship. Interestingly, male postdocs indicated a slightly higher intention to pursue academic careers over female postdocs. 51% of male respondents vs. 46% of female respondents intend to pursue research faculty positions (**Figure 8a)**. The only other notable difference across gender was in teaching careers, with 5% more women interested in teaching-intensive faculty careers. There was no significant difference in career interest across race and ethnicity with the maximum difference also in teaching careers (**Figure 8b)**. Citizenship showed a greater difference in academic careers but only by 4% (**Figure 8c)**.

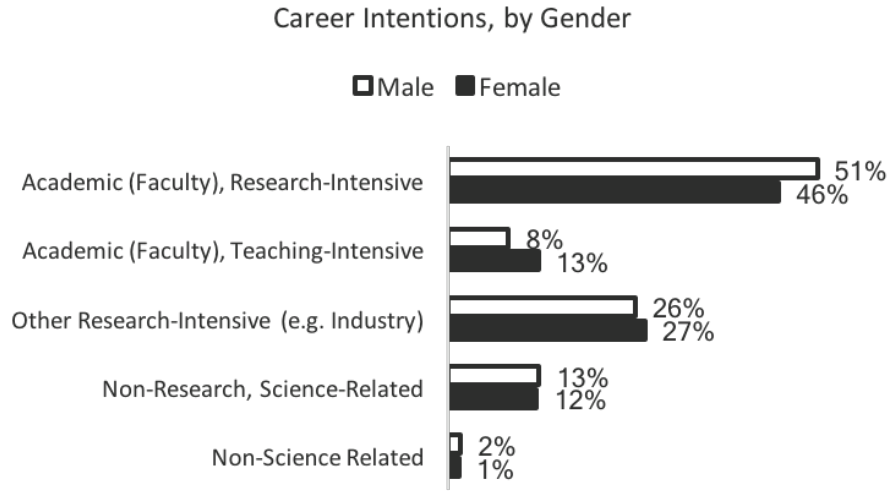
We further explored differences in career intention by both gender and underrepresentation. URM males displayed the lowest intention toward academia with 43% of respondents choosing this path (**Figure 9**). Whereas 51% of non-URM males intended to pursue academic positions. URM males accounted for the lowest percentage of respondents in industry careers, but the highest percentage of respondents in teaching, non-research, and non-science careers.

Next, we explored the productivity of biomedical postdocs by gender, underrepresentation, and citizenship. URM and women postdocs were found to have the lowest total number of publications, and URM postdocs particularly were found to have lower numbers of first-author publications, lower first-author publication rates, and the lowest impact factors of journals in which they publish (**Table 4**).

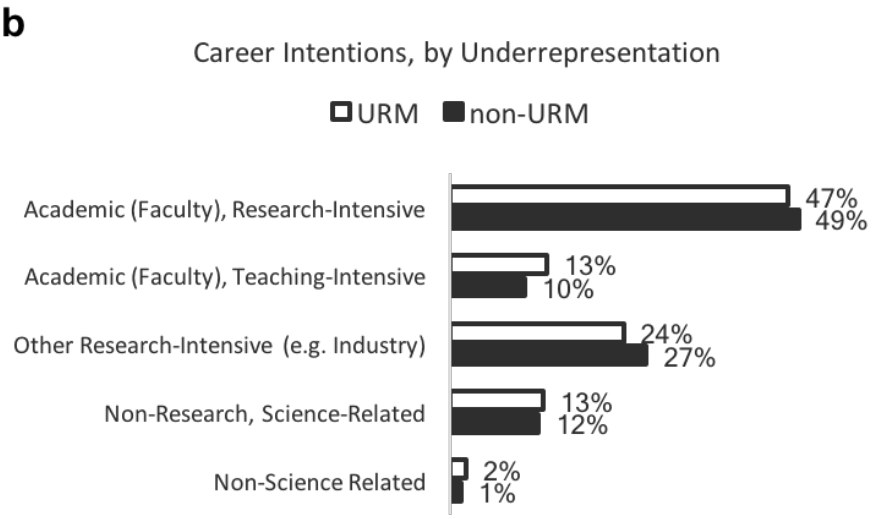
To better understand the differences in outcome expectations and self-efficacy across demographics we determined overall scores from the outcome expectations and self-efficacy scales included in the U-MARC survey. Male postdocs scored higher on both the outcome expectations and self-efficacy scales with scores of 3.36 and 3.81

Figure 8 - Career intentions patterns of biomedical postdocs, by social identity. Postdocs indicated the most likely career they would pursue and the % respondents were compared across (a) gender (b) underrepresentation and (c) citizenship status. URM, Underrepresented Minority. Intl, International Postdoc.

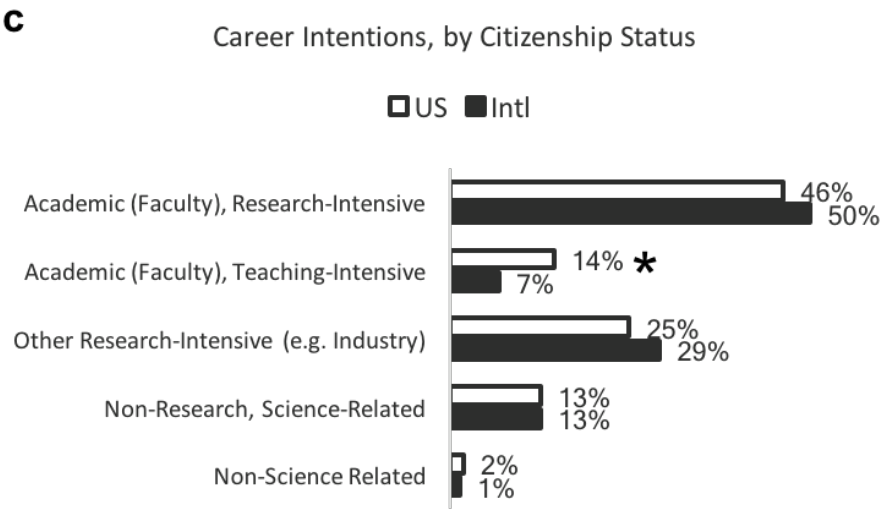
a


Career Intentions, by Gender
Male
Female
Academic (Faculty), Research-Intensive
51%
46%
Academic (Faculty), Teaching-Intensive
8%
13%
Other Research-Intensive (e.g. Industry)
26%
27%
Non-Research, Science-Related
13%
12%
Non-Science Related
2%
1%

b


Career Intentions, by Underrepresentation
URM
non-URM
Academic (Faculty), Research-Intensive
47%
49%
Academic (Faculty), Teaching-Intensive
13%
10%
Other Research-Intensive (e.g. Industry)
24%
27%
Non-Research, Science-Related
13%
12%
Non-Science Related
2%
1%

c


Career Intentions, by Citizenship Status
US
Intl
Academic (Faculty), Research-Intensive
46%
50%
Academic (Faculty), Teaching-Intensive
14% *
7%
Other Research-Intensive (e.g. Industry)
25%
29%
Non-Research, Science-Related
13%
13%
Non-Science Related
2%
1%

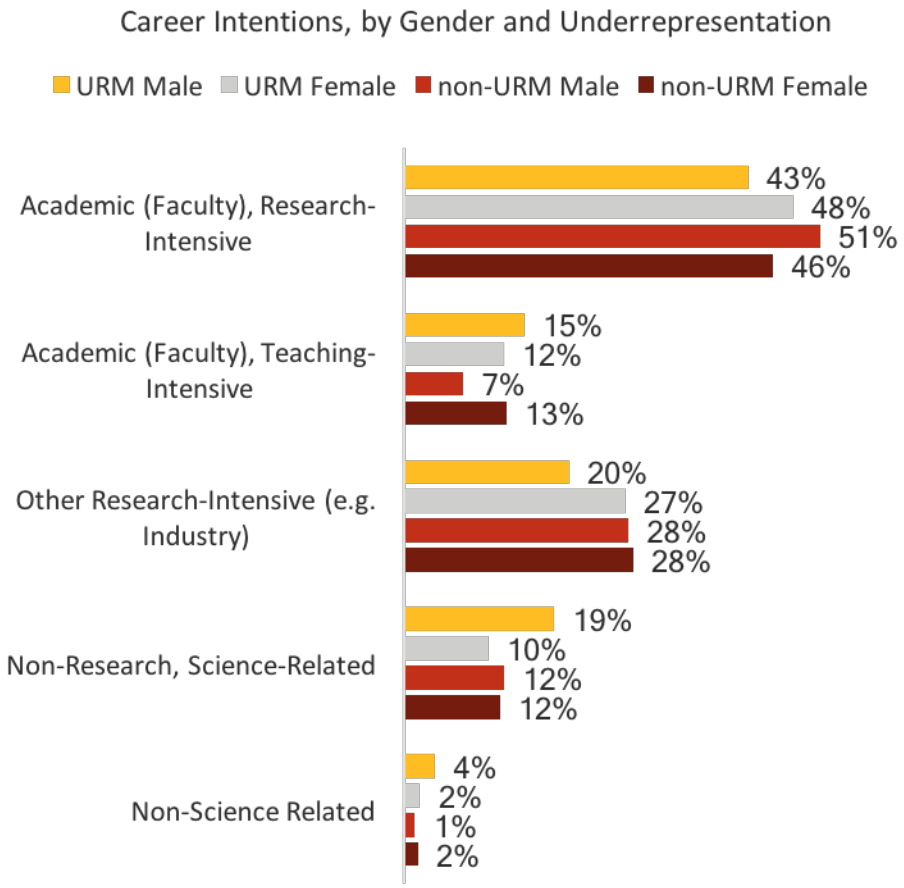


Figure 9 - Career Intentions, by gender and underrepresentation.

Table 4 – Publication productivity by gender, underrepresentation, or citizenship.

	Total # Publications	**# of First-Author Publications**	**First-Author Publication Rate**	**Highest Impact Factor**
All	8.0 [5.0;12.0]	3.0 [2.0;5.0]	0.50 [0.27;0.82]	8.50 [4.94;13.2]
Male	8.0 [5.0;13.0]	3.0 [2.0;6.0]	0.51 [0.29;0.92]	9.10 [5.00;13.9]
Female	7.0 [5.0;11.0]	3.0 [2.0;5.0]	0.47 [0.26;0.77]	8.20 [4.72;12.8]
URM	7.0 [4.0;10.0]	2.0 [2.0;4.0]	0.38 [0.22;0.70]	6.57 [4.80;12.0]
Non-URM	8.0 [5.0;12.0]	3.0 [2.0;5.0]	0.51 [0.29;0.85]	8.82 [4.97;13.5]
US Citizen	8.0 [5.0;11.0]	3.0 [2.0;5.0]	0.47 [0.27;0.74]	8.24 [4.70;13.2]
International	8.0 [5.0;12.0]	3.0 [2.0;5.0]	0.51 [0.27;0.92]	8.90 [5.10;13.2]

($p<0.001$), respectively (**Figure 10a**). Women scores were significantly lower at 3.18 and 3.61, respectively. Interestingly, there was no difference in outcome expectations between URM and non-URM postdocs, however, URM postdocs exhibited a higher self-efficacy score ($p<0.01$) (**Figure 10b**).

We further explored these differences in self-efficacy by assessing individual questions in the scale. While the percentage of women and men respondents did not differ for the statement, *I have the ability to achieve a successful career as a researcher,* a lower percentage of female postdocs agreed that they could publish in top journals or secure grants in their field (**Figure 10c**). Despite, lower publication rates and lower associated impact factors, higher percentages of URM postdocs agreed that they could publish in journals such as Nature, Science, and Cell (**Figure 10d**). More URM postdocs also agree with their overall ability to achieve a research career.

Work-life balance is more challenging among women with lower self-efficacy

The social cognitive career theory suggests that background contextual factors (or affordances) affect the development of self-efficacy, which influences career choice behavior. To better understand the environmental and contextual factors that contribute to female postdocs' lower self-efficacy in achieving grants and top publications, we explored open-ended responses of women who strongly disagreed and disagreed with the statement: *If I work hard in the lab I can expect a publication in a top journal.*

We found that women postdocs who disagreed with this statement (marking lower self-efficacy) perceived a very poor work-life balance. While all postdocs noted the difficulty of sustaining a postdoc and potential academic career given contextual factors such as children or low postdoc salary, women with lower self-efficacy perceived multiple and more severe barriers, coupled with the lack of affordances. For example, one postdoc notes: *I am a mother of two children, including one special*

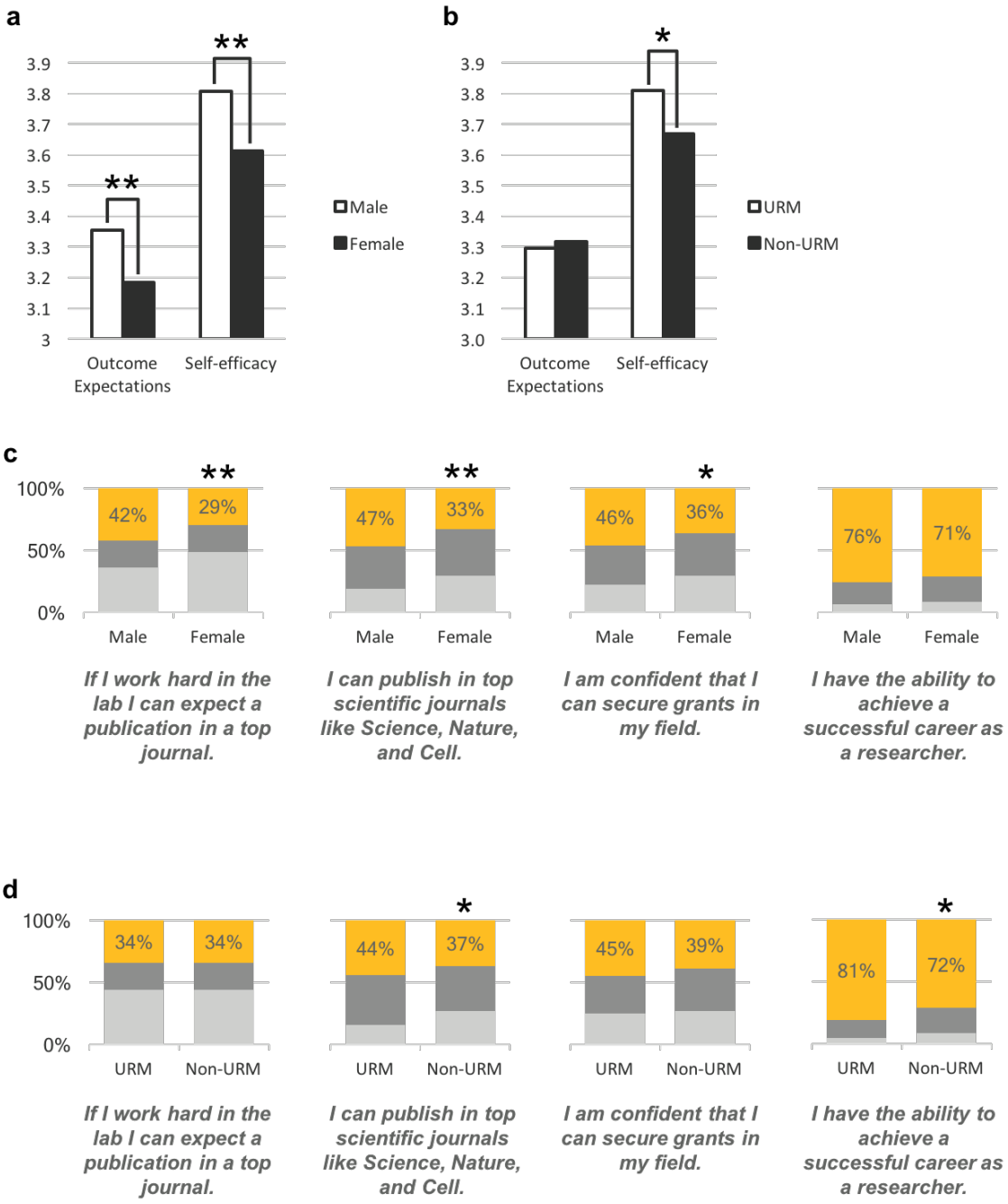


Figure 10 - Outcome expectations and self-efficacy for research careers across gender and underrepresentation. Outcome expectations and self-efficacy scores for (a) male and female postdocs and (b) URM and non-URM postdocs. (c) Percent respondents for questions around self-efficacy across gender. (d) Percent respondents for questions around self-efficacy across underrepresentation.

needs child, and I also support my mother. The low salary in academia and the current climate of grants has eliminated [academia] as a choice for my career. I also have over $100k in student loans, which is impeding my process of purchasing a home because I cannot pay them off quickly. Therefore, I need a career with a much larger salary. (This postdoc intends to pursue a research career outside of academia, such as in industry.)

Environmental and contextual factors that were perceived as barriers or challenges to achieving an academic research career can be summarized in the following: (1) being a parent or primary caregiver of a relative, (2) financial insecurity, (3) lack of flexibility for relocating, and (4) limited overall work-life balance. The perceived affordances cited by many female postdocs that permit greater career choice include: (1) a supportive partner/spouse, (2) flexibility to relocation, (3) financial stability, and (4) being a U.S. citizen or permanent resident. We explain some of these below and discuss their acute frequency within female postdocs with relative high or low self-efficacy.

Many female postdocs acknowledge the challenges that accompany being a parent or primary caregiver. However, women postdocs with lower self-efficacy cite multiple factors that accompany parenting such as lack of flexible work hours, greater financial pressures, new, evolved values (i.e. wanting to spend more time with family), and even concerns about discrimination and perceived productivity. One female postdoc notes: *I want to have children but my PI will not be supportive of me not being in the lab. All PIs will say they don't discriminate against women during the interview, but pregnancy slows us down more than men. Once you join a lab there is often too much pressure to produce to feel comfortable asking for the time off.* Another female postdoc with lower self-efficacy notes: *I got two kids so I cannot take high risks financially anymore.*

Finances and low salary remain another concern for female postdocs. Those with low self-efficacy indicate how finances are more than just an inconvenience or setback. Many female postdocs with higher self-efficacy acknowledge how financial security and stability have afforded them the opportunity to choose academic research

careers. *I might not have chosen academia were I not able to afford to be 'underpaid' as a postdoc (as opposed to working as a scientist in industry) these 5 or so years.* Another postdoc indicates: *My parents supported me financially during my PhD.* This postdoc intends to pursue academia: *I have the flexibility to enter an academic career because I have no student debt and a safety net in my family. If I felt more financially insecure or had more pressing financial concerns, I wouldn't have the privilege to take such large risks.*

Some female postdocs with lower self-efficacy cite geographical inflexibility as a concern in pursuing faculty positions. Many postdocs are limited to their current city because of their spouse's job or want to remain close to family for their career. *My husband has a well-paid job in NYC. I moved to NYC (and will stay in NYC) because of his job. I will not pursue a job outside of NYC.* One female postdoc highlights her affordance in this domain to her career choice: *I have a very supportive husband who will follow me anywhere I go (almost!).*

Overall, many female postdocs indicate a concern for work-life balance, even those with higher self-efficacy. All postdocs largely believed that achieving and thriving in a successful research faculty career requires long work hours and perhaps initially some geographical flexibility. However, those postdocs with lower self-efficacy more often cited barriers that could affect their career intentions. For example, having children in and of itself was equally common among female postdocs with high and low self-efficacy. However, women with lower self-efficacy faced challenges that opposed what they perceived as the necessary time or support needed to publish in top journals, obtain grants, or thrive in faculty positions. One mother notes: *I have a child, and my partner does not want to move. I very much want to get an academic faculty position at a research institution, but don't know how we're going to work out child custody.* While another says: *The fact that my husband has a high paying job, not in science, makes it significantly easier for me to pursue an academic research career, and to manage having a family. While I benefit significantly from this fact, it strikes me as highly unfair that I have a better chance of success because I can afford to work on a post-doc salary.*

URM postdocs find solace in 'community'

We also explored open-ended responses of URM postdocs who demonstrated higher self-efficacy in achieving a research career. While many also expressed concerns around balancing work and family responsibilities, some URM postdocs expressed the need for a diverse representation in science. This for some served as a source of motivation. One postdoc explains: *I am a black woman in science. My lack of representation serves as a burden and a motivation factor to be faculty.* Another postdoc goes on to provide advice: *Do not second guess your ideas just because they are different than the rest. That is precisely why we need to be at the table.*

While it is not clear from the data what factors explicitly associate with higher self-efficacy among URM postdocs, some URM postdocs have identified the support of a community within science as a key for persistence. *The greatest component to my success thus far has been asking the right people for help with grants, experiments, and other challenges. Without the support of my community it would be difficult to push forward research initiatives and secure funding for them.* Others note: *Surround yourself with a good team of mentors and mentees.* And: *Get a community that supports you. Talk a lot about your science.*

DISCUSSION

This study sought to better understand and characterize differences in career choice across gender, underrepresentation, and citizenship. We found that while differences in career intentions were not large, they were significant. They also associated with differences in factors such as outcome expectations about research careers and self-efficacy towards publishing and securing grants. Previous literature reminds us that individuals tend to perform at high levels when their self-efficacy is high. This may be a true for many female postdocs. We also know that men tend to over inflate their actual capabilities while women are much more modest in their assessments.

Upon further exploration, we discovered that barriers such as financial insecurity and being a parent contributed to changing values and new perceptions around work-life balance. Many of the postdocs who felt most comfortable choosing academic careers cited adequate support with family and childcare, financial stability, and geographical flexibility. Postdocs are less likely to translate their career interests into goals, and their goals into actions, when they perceive their efforts to be obstructed by adverse environmental factors (e.g., insurmountable barriers or inadequate support systems). Conversely, the perception of beneficial environmental factors (e.g., ample support, few barriers) is predicted to facilitate the process of translating a person's interests into goals and goals into actions.

As institutions consider how best to increase and support diversity in the biomedical sciences, these data will be important to consider. Postdocs need support in more than just academic capacities, so that they have the freedom to make career choices that fit their talents and values. We asked postdocs whether certain type of interventions would be helpful to their choice in choosing research careers. While many acknowledged that interventions such as a defined mentor outside of their lab would be helpful, URM postdocs overwhelmingly indicated the need for other support as well. For example, 49% of URM postdocs training in and opportunities to conduct health disparities research, compared to only 29% of non-URM postdocs. They also believed that more fellowships and grants to support URM investigators would increase their likelihood to pursue an academic research career. Ultimately, a changing career landscape has had a profound effect on the interests and motivations of postdoctoral researchers, the key demographic for faculty recruitment. Many of the factors that contributed to the success of postdocs 30 years ago no longer have the same effect. Future studies should explore both support and mentorship interventions that guide postdocs in navigating the academic playing field but also provide them

with the support in their everyday lives to achieve the best positions for their values. This will be a necessary step to increasing and supporting diversity in the academy.

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APPENDIX A

U-MARC: Understanding Motivations for Academic Research Careers

Informed Consent

TITLE OF STUDY

U-MARC Study: Understanding Motivations for Academic Research Careers

PRINCIPAL INVESTIGATOR

Linnie M. Golightly, M.D. Associate Dean for Diversity Associate Professor of Clinical Medicine, Microbiology & Immunology Weill Cornell Medicine 1300 York Avenue, Room A-421 New York, New York 10065

W. Marcus Lambert, Ph.D. (co-PI), Director of Diversity and Student Services Weill Cornell Graduate School of Medical Sciences Weill Cornell Medicine 1300 York Avenue, Room A-131 New York, New York 10065

PURPOSE OF STUDY

You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

Dr. W. Marcus Lambert (Weill Cornell Medicine) and Dr. Linnie Golightly (Weill Cornell Medicine) are conducting a study to better understand the factors that influence interest in an academic research career. You are being asked to participate in this research study because you are conducting a biomedical or biological postdoctoral fellowship at an academic institution.

NUMBER OF SUBJECTS

We project a sample size of 300-350 participants for this study.

STUDY PROCEDURES

If you agree to participate, you will be asked to complete a survey that includes questions about your career intention, your postdoc experience, and factors that have influenced your career choice. The survey will take approximately 10-15 minutes to complete.

This survey is anonymous and no identifying information will be associated with your survey responses.

RISKS

Participants in this study may perceive some questions as sensitive.

You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

BENEFITS

There will be no direct benefit to you for your participation in this study. However, we hope that the information obtained from this study will bring benefit to others as they make more informed choices about the career options available to them after a PhD.

CONFIDENTIALITY

Your responses to this survey will be anonymous. Please do not write any identifying information on your survey. This signed Consent and the Contact Information post-survey are submitted separately from the U-MARC Survey so that we will not identify survey responses.

COMPENSATION

To thank you for participating in the survey, we will be awarding three $100 Amazon e-gift cards via a random drawing from all respondents who complete the post-survey contact information form.

You will not be eligible for compensation if you do not complete the survey and the post-form so that we know where to send your gift card if you win the drawing. This U-MARC survey is anonymous and no identifying information will be associated with your survey responses. The drawing will take place after the closer of the survey.

CONTACT INFORMATION

If you have questions at any time about this study, or you experience adverse effects as the result of participating in this study, you may contact the researcher whose contact information is provided on the first page. If you have questions regarding your rights as a research participant, or if problems arise which you do not feel you can discuss with the Primary Investigator, please contact the Institutional Review Board at (865) 354-3000, ext. 4822.

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher.

CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Add signature to proceed

Education and Experience

Highest degree earned:

- ☐ PhD
- ☐ MD (not PhD)
- ☐ MD/PhD
- ☐ Other

Are you a 'postdoc' (Postdoctoral Researcher/Fellow)?

- ◯ Yes
- ◯ No, I have another classification/title

Please indicate your classification/title (e.g., Research Associate) _____

Please indicate the date you started your PhD training. _____ ((To the best of your knowledge.))

Please indicate the date you defended your PhD. _____ ((To the best of your knowledge.))

Time to degree _____

Time post-PhD _____

Please indicate your current academic institution. _____

Please indicate the date you started your current (postdoctoral) position. _____ ((To the best of your knowledge.))

Current postdoc length _____

How many postdoctoral positions have you held (including your current position, if your current position is a "postdoc")? _____

Please select your primary (or best fitting) field of study:

- ◯ Anatomy
- ◯ Bacteriology
- ◯ Biochemistry
- ◯ Bioinformatics
- ◯ Biology/Biomedical Sciences, General
- ◯ Biology/Biomedical Sciences, Other
- ◯ Biomedical Sciences
- ◯ Biometrics & Biostatistics
- ◯ Biophysics
- ◯ Biotechnology
- ◯ Botany/Plant Biology
- ◯ Cancer Biology
- ◯ Cell/Cellular Biology & Histology
- ◯ Computational Biology
- ◯ Developmental Biology/Embryology
- ◯ Ecology
- ◯ Endocrinology
- ◯ Entomology
- ◯ Environmental Toxicology
- ◯ Epidemiology
- ◯ Evolutionary Biology
- ◯ Genetics/Genomics, Human & Animal
- ◯ Immunology
- ◯ Marine Biology & Biological Oceanography
- ◯ Microbiology
- ◯ Molecular Biology
- ◯ Neurosciences & Neurobiology
- ◯ Nutrition Sciences
- ◯ Parasitology
- ◯ Pathology
- ◯ Pharmacology
- ◯ Physiology
- ◯ Plant Genetics
- ◯ Plant Pathology/Phytopathology
- ◯ Plant Physiology
- ◯ Structural Biology
- ◯ Toxicology
- ◯ Virology
- ◯ Wildlife Biology
- ◯ Zoology
- ◯ Other

How many publications do you have (published and under review)?

(Place a mark on the scale above)

Please indicate your number of first author publications.

(Place a mark on the scale above)

First author publication rate (# of first author publications/years in research): _____

Of the journals in which you have published, what is the highest impact factor? (Google: name of journal + "impact factor") _____

((i.e., For PNAS, enter: 9.4))

Demographic Information - (Confidentiality is important to us. Your identify will remain anonymous.)

Are you a U.S. citizen / permanent resident of the United States?
- ◯ Yes
- ◯ No

Ethnicity:
- ◯ Hispanic or Latino
- ◯ Not Hispanic or Latino

Race:
- ☐ American Indian or Alaskan Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

To which gender identity do you most identify?
- ◯ Female
- ◯ Male
- ◯ Other

If "other", please specify: _____

How do you self-identify?
- ◯ Straight or Heterosexual
- ◯ Gay or Lesbian
- ◯ Bisexual
- ◯ Other

If "other", please specify: _____

Marital status:
- ◯ Single
- ◯ Married
- ◯ Domestic Partner/Living with Partner

Do you have children or dependents?
- ◯ Yes
- ◯ No

Have you ever received or been eligible for a low-income (need-based) grant or loan as a student?
- ◯ Yes
- ◯ No

Select the highest grade level completed by your parents.
- ◯ Did Not Complete High School
- ◯ High School/GED
- ◯ Some College
- ◯ Associate's Degree
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Doctorate

How would you rate your understanding of the careers available to you?
- ◯ Significant
- ◯ Moderate
- ◯ Very little

Please rank the following career paths from Most likely to pursue to Least likely to pursue. (Only one selection is allowed per column.)

	Most likely to pursue	More likely to pursue	Equally likely to pursue	Less likely to pursue	Least likely to pursue
Academic (Faculty), Research-Intensive	○	○	○	○	○
Academic (Faculty), Teaching-Intensive	○	○	○	○	○
Other Research-Intensive (e.g. Industry)	○	○	○	○	○
Non-Research, Science-Related	○	○	○	○	○
Non-Science Related	○	○	○	○	○

How has your commitment to this career path changed, since starting your first postdoc?

	More committed	Stayed the same	Less committed
Academic (Faculty), Research-Intensive	○	○	○
Academic (Faculty), Teaching-Intensive	○	○	○
Other Research-Intensive (e.g. Industry)	○	○	○
Non-Research, Science-Related	○	○	○
Non-Science Related	○	○	○

Please rate how strongly you disagree or agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My career choice is highly influenced by the current grant funding climate.	○	○	○	○	○
Guidance from my lab PI has highly influenced which career path I will pursue.	○	○	○	○	○
Guidance from mentors other than my PI has highly influenced which career path I will pursue.	○	○	○	○	○
My career choice is highly influenced by my passion for science and discovery.	○	○	○	○	○
My career choice is highly influenced by my success thus far in research (grants, publications, awards).	○	○	○	○	○
My career choice is highly influenced by my personal life circumstances.	○	○	○	○	○
My career choice is highly influenced by the job prospects my field.	○	○	○	○	○
My career choice is highly influenced by my immigration status or citizenship.	○	○	○	○	○

You mentioned that your career choice is highly influenced by your personal life circumstances. Please explain. _____

Influential factors Please rate how strongly you disagree or agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Financial security is one of the top reasons for my career choice.	○	○	○	○	○
My career choice is highly influenced by the career choices of my friends.	○	○	○	○	○
My career choice is highly influenced by my responsibility to my family (significant other/spouce, children, and/or other dependents).	○	○	○	○	○
My career choice is highly influenced by the lifestyle of those in the positions that I want.	○	○	○	○	○
My career choice is highly influenced by the impact that I can make on society or to a community.	○	○	○	○	○
My career choice is highly influenced by the prestige that comes with the field.	○	○	○	○	○
My career choice is highly influenced by my racial/ethnic representation in science.	○	○	○	○	○

Outcome expectations Please rate how strongly you disagree or agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
If I work hard in the lab I can expect a publication in a top journal.	○	○	○	○	○
There is a good correlation between my work effort and performance in the lab.	○	○	○	○	○
I will be successful in receiving grants and funding as long as I put in the right amount of effort.	○	○	○	○	○
Publications in top journals will lead to a faculty position.	○	○	○	○	○
Independent grant funding will lead to a faculty position.	○	○	○	○	○
A research-intensive faculty position would require more than one postdoc position.	○	○	○	○	○
A research-intensive faculty career would be very satisfying for me.	○	○	○	○	○
A research-intensive faculty career would increase my sense of self-worth.	○	○	○	○	○
My peers would think highly of me if I obtain a research-intensive faculty position.	○	○	○	○	○
Pursuing a research-intensive faculty position would enable me to associate with the kind of people that I value most.	○	○	○	○	○

Research self-efficacy Please rate how strongly you disagree or agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have the ability to have a successful career as a researcher.	○	○	○	○	○
I can publish in top scientific journals like Science, Nature, and Cell.	○	○	○	○	○
I am confident that I can secure grants in my field.	○	○	○	○	○
I can develop novel and successful research ideas.	○	○	○	○	○
I can mentor and supervise others in their training.	○	○	○	○	○

What advice would you give to someone thinking about an academic research career?

Finally, we are considering mechanisms to better support academic career interests. Would any of the following increase your likelihood to pursue an academic research career? Please rate how strongly you disagree or agree with the following items.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A course on transitioning to research independence that covers all aspects of obtaining a faculty position would increase my likelihood to pursue an academic research career.	○	○	○	○	○
A course on how to teach science and the pedogy of scientific teaching would increase my likelihood to pursue an academic research career.	○	○	○	○	○
A defined mentor outside of my lab that would help in the step-by-step guidance of my career would increase my likelihood to pursue an academic research career.	○	○	○	○	○
Training in and opportunities to conduct health disparities research would increase my likelihood to pursue an academic research career.	○	○	○	○	○
Specific educational training that would permit the application of basic science principles in community-based settings would increase my likelihood to pursue an academic research career.	○	○	○	○	○
Fellowships and grants to support URM investigators would increase my likelihood to pursue an academic research career.	○	○	○	○	○

APPENDIX B

Table A – Institutions from which participating postdocs have appointments.

	Total	***Percentage***
Stanford University (129 or 130)	130	12%
Mount Sinai (90)	90	9%
Weill Cornell Medicine (73)	73	7%
University of California San Francisco (73)	73	7%
Memorial Sloan Kettering Cancer Center (61)	61	6%
University of Chicago (57)	57	5%
Columbia University (50)	50	5%
Albert Einstein School of Medicine (42)	42	4%
University of Texas (42)	42	4%
University of Utah (40)	40	4%
Medical College of Wisconsin (39)	39	4%
University of California San Diego (34)	34	3%
University of North Carolina Chapel Hill (34)	34	3%
Boston University (33)	33	3%
National Institutes of Health (22)	22	3%
Rockefeller University (31)	31	3%
University of Maryland Baltimore (28)	28	3%
University of Cincinnati (23)	23	2%
Fred Hutchinson Cancer Research Center (18)	18	2%
University of Colorado (11)	11	1%
City University of New York (CUNY) (14)	14	1%
Cedars-Sinai Medical Center (13)	13	1%
University of Tennessee (13)	13	1%
Ohio State University (10)	10	1%
Cleveland Clinic (10)	10	1%
Northwestern University (9)	9	1%
Emory University (5)	5	0%
Penn State University (5)	5	0%
Massachusetts Institute of Technology (4)	4	0%
Rosalind Franklin Medical Center (4)	4	0%
Van Andel Research Institute (3)	3	0%
Center for Disease Control (3)	3	0%
University of Rochester (3)	3	0%

Thomas Jefferson University (3)	3	0%
Texas Tech University (2)	2	0%
Salk Institute (2)	2	0%
Oakland University (1)	1	0%
University of Massachusetts Amherst (1)	1	0%
University of Oklahoma (1)	1	0%
Heart Institute (1)	1	0%
University of California Los Angeles (1)	1	0%
Dana Faber Cancer Institute (1)	1	0%
Institute Systems of Biology (1)	1	0%
University of Arizona (1)	1	0%
Center for Infectious Disease Research (1)	1	0%
University of Iowa (1)	1	0%
Benaroya Research Institute (1)	1	0%
New York Presbyterian (1)	1	0%
Columbia University Mailman School of PH(1)	1	0%
Vanderbilt University (1)	1	0%
Aaron Diamond Aids Research (1)	1	0%
Buck Institute for Research on Aging (1)	1	0%